PATENT SPECIFICATION

733,853

Date of Application and filing Complete Specification: April 18, 1951. No. 9064/51.

Application made in United States of America on Dec. 18, 1950.

Complete Specification Published: July 20, 1955.

Index at acceptance:—Class 39(1), D12B(1:3:4), D12(C:D), D(17A2A:35).

COMPLETE SPECIFICATION

Improvements in or relating to Electrodes for Gaseous Discharge Lamps

I, HERMANN EDUARD KREFFT, a Citizen of the Republic of Chile, of Calle Segurola 659 D to. C, Vincente Lopez, Province of Buenos Aires, Argentina, South America, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to electrodes for electrical gas discharge lamps and more particularly to activated electrodes for high pressure and super high pressure lamps.

The terms "high pressure lamp" and "super high pressure lamp" in accordance with the present invention refer to electrical discharge lamps which operate under pressures of from about one atmosphere and above about ten atmospheres respectively, and which contain, under operating conditions, a metal vapour, e.g., mercury vapour, to which is added an inert gas, or which may contain a mixture of metal vapours or a mixture of metal vapours and rare gases, e.g., krypton and xenon.

In such lamps, as it is known, the discharge forms an arc of high temperature which, owing to the high current density, is limited to a very small area of the electrode. Consequently, the electrodes are exposed locally to very high temperatures which cause evaporation of electrode material. Through this process, electrode life is limited, and the bulb of the lamp is blackened. Electrodes for high pressure or super high pressure lamps are, therefore, mostly made of tungsten, and they are provided with a certain amount of activating materials through which their temperature is lowered. These activating materials are also required in order to improve starting of the discharge. Such activating materials are the metals barium, calcium, strontium, thorium, or the oxides thereof and the dioxides of thorium and zirconium. However, these activating materials, although they lower the temperature of the electrodes, may produce considerable blackening of the bulb as they evaporate rather easily. It is, therefore, very important to limit their quantity, and to add them to the electrode in such a way that they produce sufficient activation without being excessively exposed to the action of the discharge arc.

It is, therefore, one object of my invention to provide an activated electrode for high pressure and super high pressure lamps which does not blacken the wall of the discharge vessel; another object is to provide an electrode which starts easily and without sputtering; still another object is an electrode of the coiled coil type; a further object is a novel electrode of the storage type; another object is an electrode of the self heating type.

According to the present invention, an activated electrode of the self heating and storage type for gaseous electric discharge lamps comprises a coil assembly composed of a core formed by a plurality of metallic wires of high melting point, so arranged as to enclose a channel, a tungsten wire coil which is helically wound about and firmly connected on said core so as to leave channels between the core and the coil, the individual convolutions of said coil being closely adjacent to one another to form a protecting wall, and a store of activating material arranged inside said coil in the channels formed between the wires of the core and between the core and the coil.

This coil assembly is preferably coiled by which means an electrode of the coiled coil type is produced which possesses a mechanically strong structure, and which is provided, in a particularly convenient way, with a store of activating materials.

For a better understanding of the invention and to show how the same may be carried into effect, reference will now be made to the accompanying drawings, in which:—

[Price 3/-]

Price 4s 5d

Fig. 1 is a transverse, partly sectional view of an electrode coil, provided with a core;

Fig. 2 is a longitudinal sectional view of the electrode coil, taken on the line II—II of Fig. 1 illustrating the structure of the core;

Fig. 3 is another transverse, partly sectional view of the electrode coil according to Fig. 1, illustrating the positions of a gas absorbing wire and of the activating material;

Fig. 4 illustrates a modification of the arrangement of the core wires;

Fig. 5 is a diagrammatic, partly sectional view of a coiled coil electrode; and

Fig. 6 is another schematic representation of a coiled coil electrode.

As shown in Fig. 1, which is a transverse partly sectional view of an electrode, the core contained in its interior consists of four metallic wires 1, 2, 3 and 4, on which the coil 5 is helically wound and firmly connected. The interior of the coil is not entirely occupied by the core wires which form, with the coil, and between themselves, channels 6 and 7. In Fig. 2, which is a longitudinal sectional view of the same coil, taken on the line II—II of Fig. 1, the core wires 2 and 4, the central channel 7 and transverse sections of the coil 5 are shown.

The coil 5 consists of a tungsten wire, while the core is composed of tungsten, molybdenum, tantalum, or thorium wires, or of a combination of wires consisting of these metals. A preferred combination of the core consists of three tungsten wires and one tantalum or thorium wire. The invention, however, is not limited to the use of four core wires which number is indicated by way of example only. As shown in Fig. 3, a centrally located fifth gas absorbing core wire 9 may be added to the structure already described. This central wire may be made either of tantalum or thorium, while the others, 1, 2, 3 and 4, are tungsten wires, or at least partly consist of tungsten, and partly of the other metals mentioned. The channels which are formed between the wires of the core and between the core and the coil, are filled with activating materials 8 composed, for example, of the oxides of barium, calcium, strontium, or thorium, or of zirconium dioxide, or of mixtures of these materials the particle size of which should be chosen as small as possible.

This electrode structure offers many advantages as it combines several properties required by high pressure lamps, or other lamps which start with cold electrodes. In the first place, the coil provided with a core is an element with considerable mechanical strength which can be utilised for the construction of other complex electrode structures; furthermore, the pockets or channels which exist in the interior of the coil, are excellent places for the activating materials which must be protected from the direct action of the discharge arc, but should be well distributed all over the electrode, and close to its surface; another advantage is the use of gas absorbing or activating metals as a component of the core. These advantages would not exist if a solid core were used instead of a plurality of core wires which form a flexible core.

Since a core, composed according to the present invention, is flexible, the electrode structure, or primary coil assembly, which I have described may be coiled up to form a secondary coil. To this end, however, it is convenient to twist the core wires, as shown in Fig. 4, which illustrates a primary coil assembly composed of four twisted core wires 1, 2, 3 and 4, and a coil 5. According to Fig. 5, an electrode embodying my invention consists of a secondary coil 10 which forms a hollow cylindrical body, supported by a coaxial wire or rod 11 which fits accurately into the interior of the coil 10. This secondary coil is composed of a primary coil assembly as illustrated by Figs. 1, 2, 3 and 4, which therefore contains primary core wires 1, 2, 3, 4 and 9, and a primary coil 5. As already described, this primary coil assembly also contains, in the free spaces between the core wires, and between the core and the coil, activating materials 8 composed of the oxides of barium, calcium, strontium or thorium, or of zirconium dioxide, or of mixtures of these materials. The wire or rod 11 consists of tungsten, tantalum or molybdenum, and it may form simultaneously the inner lead of the lead wire contained in the seals of the lamp. However, this electrode supporting wire 11 need not consist of a single wire or rod, as shown in Fig. 5, but it may be also composed of a plurality of wires forming a secondary core which has the same structure as the primary core previously described. According to another embodiment of my invention, illustrated by Fig. 6, the coiled coil electrode structure is self supporting, and does not contain a coaxial supporting wire or secondary core. The electrode shown in Fig. 6 is composed of a secondary coil 10 which is formed by a primary coil assembly consisting of twisted primary core wires 1, 2 3 and 4, a fifth axial core 9, and a primary tungsten coil 5. As already described, the free spaces existing between the core wires, and between these wires and the coil 5, are filled up with activating materials.

The degree of activation of an electrode according to the present invention naturally depends on the choice and proportion of the activating materials already mentioned, and on the width of the narrow spaces which may exist between the closely adjacent convolutions of the primary coil. Therefore, this coil is given a certain small pitch during manufacture, the desirable amount of which depends on the nature and composition of

the activating materials, and which is an important means of control of electrode performance. Electrode life also depends on the quantity of activating materials contained in the electrode, which quantity is determined by the volume of the channels existing in the interior of the primary coil assembly. Obviously, a desired volume is obtained by properly choosing the size and number of the primary core wires, and the total length of the primary coil assembly.

As it is known, electrode performance and lamp life, particularly in super high pressure lamps, are considerably improved by the use of gas absorbing materials like tantalum and thorium. According to the present invention, these materials form part of the primary or secondary core of the electrode where they are exposed, under operating conditions, to temperatures which lie within a convenient range for optimum gas absorption.

During manufacture of the electrode, the primary coil is produced in a continuous process which is carried out by a customary coiling machine utilizing the primary core, which is composed of a plurality of core wires, as mandrel wire. After annealing, the second coil is produced on steel mandrel pins, or on the wire or rod which is used as secondary core, and given another heat treatment at high annealing temperatures, by which means it obtains a definite shape. Finally, the activating materials are introduced into the interior of the primary coil, which is done in the usual way by dipping the electrode into a suspension of these materials prepared with a suitable solvent and binder, like amyl acetate and nitro-cellulose.

What we claim is:—

1. An activated electrode of the self heating and storage type for gaseous electric discharge lamps comprising a coil assembly composed of a core formed by a plurality of metallic wires of high melting point so arranged as to enclose a channel, a tungsten wire coil which is helically wound about and firmly connected on said core so as to leave channels between the core and the coil, the individual convolutions of said coil being closely adjacent to one another to form a protecting wall, and a store of activating material arranged inside said coil in the channels formed between the wires of the core and between the core and the coil.

2. An activated electrode according to Claim 1, wherein the activating materials are composed of at least one of the oxides of the group consisting of barium oxide, calcium oxide, strontium oxide, thorium oxide and zirconium dioxide.

3. An activated electrode according to Claim 1, wherein said core is composed of a plurality of wires which are twisted with respect to the axis of said core.

4. An electrode according to Claim 3, wherein the coil assembly is in the form of a coiled coil.

5. An electrode according to Claim 3, wherein the coil assembly is in the form of a coiled coil, comprising a supporting means for said coiled coil, said supporting means being a second core of at least one metal wire upon which said coiled coil is wound.

6. An electrode according to Claim 1, wherein said wires of said core are tungsten wires.

7. An electrode according to Claim 1, wherein said core consists of a plurality of tungsten wires and at least one wire of thorium.

8. An electrode according to Claim 1, wherein said core consists of a plurality of tungsten wires and at least one tantalum wire.

9. An activated electrode of the self heating and storage type for gaseous electric discharge lamps comprising a coil assembly composed of a core formed by a plurality of tungsten wires so arranged as to enclose a channel and at least one wire of thorium, a tungsten wire coil which is helically wound about and firmly connected on said core so as to leave channels between the core and the coil, the individual convolutions of said coil being closely adjacent to one another to form a protecting wall, a store of activating material arranged inside said coil in the channels formed between the wires of the core and between the core and the coil, said coil assembly having the form of a coiled coil, and a supporting means for said coiled coil, said coiled coil being wound about said supporting means, said supporting means being a tungsten wire.

10. An electrode according to Claim 5, wherein said second core consists of a molybdenum wire or rod.

11. An electrode according to Claim 5, wherein said second core consists of a tantalum wire or rod.

12. An electrode according to Claim 5, wherein said supporting means forms part of the lead wire of a lamp seal.

13. An activated electrode substantially as hereinbefore described with reference to the accompanying drawings.

Dated this 18th day of April, 1951.

HASELTINE, LAKE & CO.,
28, Southampton Buildings, London, W.C.2,
and 19/25, West 44th Street, New York, U.S.A.,
Agents for the Applicant.

Printed for Her Majesty's Stationery Office by Wickes & Andrews, Ltd., E.C.4. 684/2.—1955.
Published at The Patent Office, 25, Southampton Buildings, London, W.C.2, from which copies may be obtained.

733,853 COMPLETE SPECIFICATION

1 SHEET

This drawing is a reproduction of the Original on a reduced scale.

Fig.1.

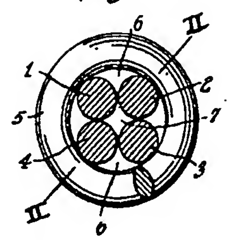

Fig.2.

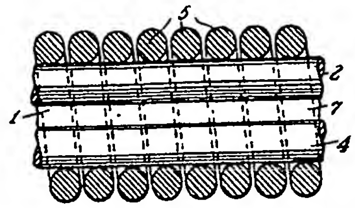

Fig.3.

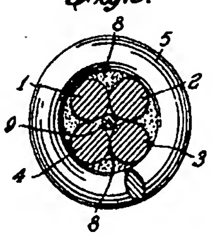

Fig.4.

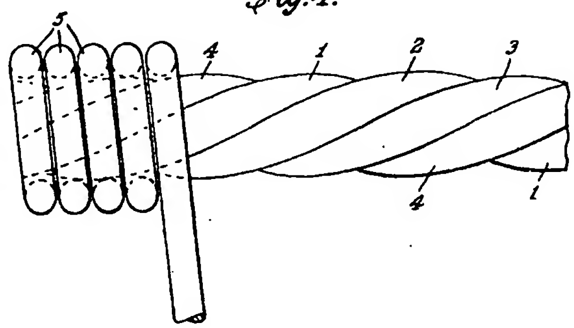

Fig.5.

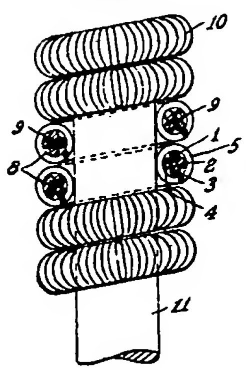

Fig.6.